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TITLE: EFFECT OF FUNGICIDE AND CULTIVAR ON BARLEY LEAF SPOT DISEASES AND YIELD AT MELFORT, SK IN 2003

CROP: Barley (*Hordeum vulgare* L.), cvs Harrington, AC Metcalfe, CDC Sisler, Xena, CDC Bold

PEST: Net blotch (*Pyrenophora teres* Drechs.), Spot blotch (*Cochliobolus sativus* (Ito & Kuribayashi) Drechs. Ex Dastur

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MATERIALS: TILT (propiconazole, 250 g.ai./L)
HEADLINE (pyraclostrobin, 250 g.ai./L)

METHODS: The experiment was seeded into wheat stubble tilled once before seeding on May 27th using a John Deere hoe drill. Forty-five kg ha^{-1} of 11-51-0 fertilizer was seed placed and 34-0-0 at 84 kg actual N ha^{-1} was broadcast on June 2nd. A split-plot design of 6 replicates was used for each cultivar (main plots) and fungicide treatment (sub-plots of 4.8 X 10 M). A preseeding burn-off was conducted with 1.25 L ha^{-1} Round-up (glyphosate). MCPA Amine 500 was applied on June 16th for broadleaf weed control. Fungicides (TILT and HEADLINE) were applied at the flag leaf stage (July 9th) at 0.5 (TILT) and 0.6 (HEADLINE) L ha^{-1} in 200 L water ha^{-1}. Diseases were assessed at the soft dough growth stage on 25 plants per plot (August 1st). Flag, Flag-1 and Flag-2 leaves were assessed on a 0-11 point scale based on the % of tissue of each leaf infected (Horsfall and Barratt 1945). Plants were also assigned a rating between 0–11 based on assessment of disease symptoms on foliage of the whole plant (McFadden 1991). Plots were harvested by straight combining 1.25 X10 M of each plot on Aug 20th.

RESULTS: See Table 1.

CONCLUSIONS: Dry conditions following fungicide application resulted in limited leaf spot severity. Disease assessment indicated light infection except for cv Harrington. Either TILT or HEADLINE fungicides reduced leaf spot symptoms compared to the check of each cultivar. Fungicide application was most beneficial for Harrington, which resulted in yield improvements of 557 (HEADLINE) and 477 (TILT) kg ha^{-1}. Similar yield increases were observed for TILT on CDC Metcalfe and HEADLINE on CDC Sisler. Thousand kernel weight or bulk density were not usually impacted by fungicide use. The percentage of plump kernels was increased greatly by either product on Harrington, but less so on other cultivars. However, due to the poor seed quality (low % plump seed), none of the cultivars would have been acceptable for malting. This was likely due to the hot dry conditions during seed filling. Of the three malting barley cultivars (Harrington, CDC Metcalfe and CDC Sisler), CDC Metcalfe followed by CDC Sisler resulted in the greatest yield.

REFERENCES:

Horsfall, J.G. and R.W. Barratt. 1945. An improved grading system for measuring plant diseases. Phytopathology 35:65.

McFadden, W. 1991. Etiology and epidemiology of leaf spotting diseases in winter wheat in Saskatchewan. Ph.D. thesis, University of Saskatchewan, Saskatoon, 151 pp.

ACKNOWLEDGEMENTS: Funding for this project was provided by SAFRR's Agri-ARM program and the Northeast Agricultural Research Foundation.

Table 1. Effect of cultivar and fungicide treatment on barley disease severity (on flag, flag-1, flag-2 and whole plot), yield, thousand kernel weight (TKW), bulk density (BD) and % plump kernels (>6/64) at Melfort, SK, 2003. Disease assessment based on proportion of infected tissue (0-11). Data are the means of 6 replicates.

Cultivar/ Fungicide Treatment	Flag leaf	Flag-1 leaf	Flag-2 leaf	Whole Plant	Yield kg/ha	TKW grams	BD kg/hl	% Plump
Harrington								
Check	3.5	5.1	8.0	7.6	4249	56.9	26.5	29.8
Tilt	2.0*‡	3.3*	5.9*	4.6*	4726*	58.2	28.4	40.5*
Headline	1.7*	2.2*	4.2*	2.6*	4806*	58.3	28.9*	43.4*
$LSD_{(0.05)}$ †	0.6	0.8	0.8	0.9	454	1.9	2.2	10.4
CDC Metcalfe								
Check	1.0	1.8	4.3	2.5	5181	62.6	31.9	55.6
Tilt	1.0	1.1*	2.5*	1.5*	5691*	64.2	33.7	63.9
Headline	0.2*	1.0*	2.0*	1.2*	5466	65.0	33.9	62.2
$LSD_{(0.05)}$	0.7	0.3	0.9	0.7	479	1.4	2.9	9.3
CDC Sisler								
Check	0.7	0.8	2.0	1.1	4768	60.2	25.6	32.4
Tilt	0.7	0.6*	1.1*	1.0	4994	60.1	26.5	35.0
Headline	0.2	0.4*	0.7*	0.9*	5315*	61.9	27.3*	41.4*
$LSD_{(0.05)}$	0.5	0.2	0.7	0.1	361	1.7	0.9	6.9
Xena								
Check	0.3	1.2	2.7	1.3	5827	64.8	33.6	46.6
Tilt	0.5	0.9	2.0*	1.2	5588	64.6	34.4	46.2
Headline	0	0.5*	0.9*	1.0*	5885	66.0*	34.8	52.6
$LSD_{(0.05)}$	0.6	0.3	0.6	0.3	583	1.1	2.1	11.1
CDC Bold								
Check	1.0	2.2	4.3	2.4	5555	63.6	32.1	36.6
Tilt	0.7	1.1*	2.9*	1.4*	5904	65.0	33.6	44.7
Headline	0.5*	0.8*	1.9*	1.1*	5896	65.0	34.5	47.9*
$LSD_{(0.05)}$	0.5	0.5	0.6	0.5	567	1.5	2.5	9.7

† indicates differences among means according to the least significant difference test.

‡ indicates significant difference between fungicide treatment and check.

TITLE: EFFECT OF FUNGICIDE AND CULTIVAR ON WHEAT LEAF SPOT DISEASES AND YIELD AT MELFORT, SK IN 2003

CROP: Wheat (*Triticum aestivum* L.), cvs. AC Barrie, Superb, AC Intrepid, Prodigy, AC Crystal

PEST: Septoria complex (*Septoria tritici* Rob. in Desm. and *S. nodorum* (Berk.) Berk.), Tan spot (*Pyrenophora tritici-repentis* (Died.) Drechs., Spot blotch (*Cochliobolus sativus* (Ito & Kuribayashi) Drechs. Ex Dastur

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MATERIALS : TILT (propiconazole, 250 g.ai./L)
HEADLINE (pyraclostrobin, 250 g.ai./L)

METHODS: The experiment was seeded into wheat stubble tilled once before seeding on May 21th using a John Deere hoe drill. Forty-five kg ha^{-1} of 11-51-0 fertilizer was seed placed and the experiment blanket fertilized with 34-0-0 at 84 kg actual N ha^{-1} on June 4th. A split-plot design of 6 replicates was used for each cultivar (main plots) and fungicide treatment (sub-plots of 4.8 X 10 M). A preseeding burn-off was conducted with 1.25 L ha^{-1} Round-up (glyphosate). Pardner (bromoxynil) was applied on June 24th for broadleaf weed control. Fungicides (TILT and HEADLINE) were applied at the flag leaf stage (July 4th) at 0.5 (TILT) and 0.6 (HEADLINE) L ha^{-1} in 200 L water ha^{-1}. Diseases were assessed at the soft dough growth stage on 25 plants per plot (August 1st). Flag, Flag-1 and Flag-2 leaves were assessed on a 0-11 point scale based on the % of tissue of each leaf infected (Horsfall and Barratt 1945). Plants were also assigned a rating between 0 –11 based on assessment of disease symptoms on foliage of the whole plant (McFadden 1991). Plots were harvested by straight combining 1.25 X10 M of each plot on September 12th.

RESULTS: See Table 1.

CONCLUSIONS: Dry conditions following fungicide application limited leaf spot severity. Disease assessment indicated light to moderate infection except for all cultivars. Fungicides often reduced leaf spot symptoms compared to the check of each cultivar. Fungicide application was most beneficial for AC Crystal, which resulted in yield improvements of 427 (HEADLINE) and 424 (TILT) kg/ha or approximately 8.5%. AC Barrie, AC Intrepid and Prodigy were increased in yield by 3.9 to 6.6% by HEADLINE, while TILT resulted in a 6.9% increase in yield of Superb. Thousand kernel weight, bulk density or % plump kernels were not usually affected by fungicide application. Of the four bread wheat cultivars (AC Barrie, Superb, AC Intrepid and Prodigy) Superb had the highest yield. Seed quality was similar among the bread wheat cultivars except for Prodigy, which had smaller seeds.

REFERENCES:

Horsfall, J.G. and R.W. Barratt. 1945. An improved grading system for measuring plant diseases. Phytopathology 35:65.

McFadden, W. 1991. Etiology and epidemiology of leaf spotting diseases in winter wheat in Saskatchewan. Ph.D. thesis, University of Saskatchewan, Saskatoon, 151 pp.

ACKNOWLEDGEMENTS: Funding for this project was provided by SAFRR's Agri-ARM program and the Northeast Agricultural Research Foundation.

Table 1. Effect of cultivar and fungicide treatment on wheat disease severity (on flag, flag-1 and flag-2 leaves and on foliage of the whole plant), yield, thousand kernel weight (TKW), bulk density (BD) and % plump kernels (>6/64) at Melfort, SK, 2003. Leaf spots assessed on proportion of infected tissue (0-11). Data are the means of 6 replicates.

Cultivar/ Fungicide Treatment	Flag leaf	Flag-1 leaf	Flag-2 leaf	Whole Plant	Yield (kg/ha)	TKW (grams)	BD (kg/hl)	% plump kernels
AC Barrie								
Check	2.3	2.5	5.2	4.8	4214	32.8	77.3	85.4
Tilt	1.6	1.8	3.7*	3.1*	4253	32.6	77.6	87.5
Headline	1.1*‡	1.0*	2.2*	1.8*	4453*	33.5	77.6	85.4
$LSD_{(0.05)}$†	1.0	0.9	1.3	1.5	137	2.1	0.6	3.7
AC Intrepid								
Check	1.9	2.5	4.6	4.9	4411	36.1	75.2	89.1
Tilt	1.1*	1.5	3.8	2.5*	4340	36.0	75.9	88.5
Headline	0.8*	1.1*	2.6*	1.9*	4585*	35.7	76.1	88.2
$LSD_{(0.05)}$	0.8	0.9	1.4	1.8	181	2.2	0.9	4.7
AC Superb								
Check	3.2	3.2	5.2	6.1	4952	35.6	75.8	85.8
Tilt	1.5*	1.8*	3.5*	3.1*	5295*	36.9	76.7	85.2
Headline	1.1*	0.9*	2.1*	1.6*	5107	37.6*	77.1*	84.0
$LSD_{(0.05)}$	1.1	1.1	1.6	2.3	296	1.6	1.1	3.9
Prodigy								
Check	1.6	1.9	3.9	4.2	4109	29.4	76.9	84.2
Tilt	1.0	1.2	2.7	2.3*	4254	30.4	77.1	87.0
Headline	0.8	0.8*	1.8*	1.4*	4380*	30.9	77.2	84.1
$LSD_{(0.05)}$	0.9	0.8	1.3	2.0	226	1.8	0.6	4.4
AC Crystal								
Check	4.1	4.9	6.7	7.3	4965	36.1	76.4	86.9
Tilt	2.5*	3.3*	4.5*	4.7*	5389*	37.3*	77.8*	88.3
Headline	1.7*	2.0*	3.4*	2.7*	5392*	36.1	76.8	84.6
$LSD_{(0.05)}$	0.9	1.6	1.6	2.0	408	1.1	1.0	3.4

† indicates differences among means according to the least significant difference test.

‡ indicates significant difference between fungicide treatment and check.

TITLE: EFFECT OF CULTIVAR AND FUNGICIDE ON FOLIAR DISEASES OF FIELD PEA AT MELFORT, SK IN 2003

CROP: Field Pea (*Pisum sativum L.*) cvs: Alfetta, CDC Mozart, Croma, Swing, Marrow Fat 10, Espace

PEST: Powdery mildew, *Erysiphe pisi* Syd.
Mycosphaerella blight, *Mycosphaerella pinodes* (Berk. & Blox.) Vestergr./ *Phoma medicaginis* Malbr. & Roun. in Roun. var. *pinodella* (L.K. Jones) Boerema

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MATERIALS: BRAVO 500 (chlorothalonil, 500 g.ai./L)
HEADLINE (pyraclostrobin, 250 g.ai./L)

METHODS: The experiment was seeded into wheat stubble tilled once before seeding on May 13th using a John Deere hoe drill with 7" row spacing. Forty-five kg/ha of 11-51-0 fertilizer was seed placed. A split-plot design of 6 replicates was used for each cultivar (main plots) and fungicide treatment (sub-plots of 4.8 X 10 M). A preseeding burn-off was applied at 1.25 L/ha Round-up (glyphosate) and Odyssey was applied on June 4th. Fungicides were applied (BRAVO 500 - 1.0 L/ha and HEADLINE - 0.6 L/ha) at early flower (July 2nd) in 200 L water/ha. Disease infection was assessed 13 and 26 days after application using rating scales based on the proportion of foliage affected by mycosphaerella blight or powdery mildew (Xue et al. 1997) and infection of the lower stem by ascochyta foot rot (Wang 1998). All scales 0-9, where 0 = no disease. Plots were harvested by straight combining 1.25 X10 M of each plot on Aug 18th.

RESULTS: See Table 1.

CONCLUSIONS: Weather conditions were conducive to myscospherella blight infection in late June and early July but warm and dry from mid-July onward slowed infection. Disease symptoms were very low at first assessment (July 14th) and few differences were observed among cultivars or fungicide treatments. The impact of cultivar was apparent at the second assessment, with CDC Mozart and Espace affected the least by mycosphaerella blight. CDC Mozart was not affected by powdery mildew since it carries genes conferring resistance to this pathogen. Headline fungicide reduced both diseases on all cultivars, except CDC Mozart and resulted in yield increases and increased thousand kernel weight for all cultivars, except CDC Mozart. Headline also increased bulk density for cvs Swing and Espace. The single application of Bravo 500 was not usually effective to reduce disease symptoms or increase yield or quality.

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Xue, A., T.D. Warkentin, M.T. Greeniaus and R.C. Zimmer. 1997. Genotypic variability in seedborne infection of field pea by *Mycosphaerella pinodes* and its relation to foliar disease severity. Can. J. Plant Pathol. 18:370-374.

Wang, T.F. (Ting-Fu). 1998. Evaluation of mycosphaerella blight resistance in pea. M.Sc.Thesis. University of Saskatchewan, Saskatoon. 129 pp.

ACKNOWLEDGEMENTS: Funding for this project was provided by SAFRR's Agri-ARM program and the Northeast Agricultural Research Foundation.

Table 1. Effect of cultivar and fungicide treatment on disease severity, yield, bulk density (BD) and thousand kernel weight (TKW) at Melfort, SK, 2003. Mycosphaerella blight (MB), ascochyta foot rot (AFR) and powdery mildew assessed using scales based on the proportion of foliage infected (0-9). Data are the means of 6 replicates.

Cultivar/ Fungicide Treatment	Mycosphaerella blight (July 14)		Powdery Mildew (July 14)	Mycosphaerella blight (July 27)		Powdery Mildew (July 27)	Yield (kg/ha)	BD (kg hl^{-1})	TKW (grams)
	MB	AFR		MB	AFR				
Alfetta									
Check	1.0	0	0.9	4.7	3.2	6.0	3165	90.4	192
Bravo 500	0.9	0.1	0.8	3.8*	2.5	4.8*	3156	91.0	188
Headline	0.9	0	0.3*	2.5*	1.5*	4.2*	3587*	90.7	213*
$LSD_{(0.05)}$ †	0.2	0.2	0.4	0.8	0.9	0.5	341	1.3	10
CDC Mozart									
Check	1.2	0.1	0	3.4	2.3	0	4140	93.0	209
Bravo 500	1.0	0	0	3.3	1.9	0	4121	92.3	207
Headline	1.1	0	0	2.2	1.6	0	4073	92.7	212
$LSD_{(0.05)}$	0.3	0.1	-	1.1	0.7	-	473	1.3	8
Croma									
Check	0.9	0.2	1.0	4.1	2.7	6.2	3173	89.9	229
Bravo 500	0.7*‡	0	0.4*	3.6*	2.6	5.6	3388	90.2	230
Headline	0.6*	0.1	0.1*	2.1*	0.9*	4.7*	3795*	90.5	254*
$LSD_{(0.05)}$	0.2	0.2	0.4	0.5	1.0	1.0	473	1.2	6
Swing									
Check	1.1	0.1	0.8	4.4	2.0	5.0	3101	90.8	192
Bravo 500	0.8*	0.1	0.7	4.0	1.5	4.6	3215	90.5	191
Headline	0.9*	0	0.2*	2.7*	1.2*	3.3*	3593*	91.8*	216*
$LSD_{(0.05)}$	0.2	0.2	0.3	0.7	0.5	1.1	370	0.6	9
MF10									
Check	1.4	1.1	0.5	4.1	3.5	5.6	2408	91.5	226
Bravo 500	1.3	1.0	0.3	3.3	3.1	5.6	2408	91.5	228
Headline	1.1*	0.8	0*	2.5*	2.2*	4.6	2718*	90.6	241*
$LSD_{(0.05)}$	0.2	0.4	0.4	0.8	1.2	1.1	188	1.0	7
Espace									
Check	0.7	0.2	0.8	3.9	2.0	6.4	2399	90.3	148
Bravo 500	0.6*	0.1	0.7	3.9	2.6	6.5	2474	90.1	153
Headline	0.7	0.1	0.1*	2.6*	1.2	5.5*	2888*	91.2*	164*
$LSD_{(0.05)}$	0.1	0.1	0.5	0.7	0.8	0.6	469	0.8	7

† indicates differences among means according to the least significant difference test ($P \geq 0.05$).

‡ indicates significant difference between fungicide treatment and check.

TITLE: EFFECT OF TIME OF FUNGICIDE APPLICATION ON MYCOSPHAERELLA BLIGHT OF FIELD PEA AT MELFORT, SK IN 2003

CROP: Field Pea, *Pisum sativum L* cv CDC Mozart
PEST: *Mycosphaerella pinodes* (Berk. & Blox.) Vestergr./ *Phoma medicaginis* Malbr. & Roum. Var. *pinodella* (Jones) Boerema

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MATERIALS: Headline EC (250 g. ai./L pyraclostrobin)

METHODS: CDC Mozart field pea was direct seeded into heavy-harrowed wheat stubble on May 6 using a John Deere hoe drill with 7 inch row spacing. Seeding rate was 237 kg/ha at a depth of 2 inches. Just prior to planting the seed was inoculated with Cell-tech liquid inoculant. Mono-ammonium phosphate (12-51-0) was applied in the seed furrow at 44 kg/ha. The plot area was rolled to pack the soil surface when the pea plants were at the 2-3 node stage. Following in-crop herbicide application of Pursuit at 0.085 L/ac on May 28, plots were staked out into a 5 treatment randomized complete block experiment with 4 replicates. Plots were 2 x 10 meters with a 2 meter buffer zone between each plot to prevent trampling and wheel tracks through the plots when spraying with an all-terrain vehicle (ATV) mounted plot sprayer. Treatments consisted of a check and application of Headline fungicide at 0.6 L/ha in 100 L of water at timings based on growth stages 6 " stem length - Headline applied June 12, pre-flowering (10 days before flowering began) - Headline applied June 20, early flower -Headline applied June 27, and mid-flower - Headline applied July 7. Plots were monitored for disease progression throughout the growing season. Disease assessments were conducted on June 25 (no disease present), July 7 (check plots rated with very little disease present) and July 28 all plots were rated as a percent of leaf area affected on the upper, mid and lower portions of 10 plants per plot. The same 10 plants were also assessed for foot rot using the Wang 0-9 scale. Plots were straight combined on August 11, using a Wintersteiger plot combine. One pass from the centre of each plot was harvested for yield and seed quality analysis. Data were analysed using analysis of variance procedures.

RESULTS: See Table 1. Adequate soil moisture for seeding and timely showers (35mm) within two weeks of planting and again the first week of July (21 mm) allowed the crop to establish well, but hot, dry weather in mid to late July was not conducive for rapid disease development. There were few disease symptoms that developed until after the appearance of the first flowers. However, final disease assessment (July 28) indicated that application of the fungicide reduced disease compared to the unsprayed check at all timings. The fungicide was most effective on mycosphaerella blight when applied at or during flowering. Fungicide applications at the 6" vine length and 10 days pre-flower significantly reduced the disease over the check, but were not as effective as application at first or mid-flower timings. Foot rot was reduced with fungicide, but the timing of the application was not significant. Yield was increased over that of the check at the 6" vine length, and at early and mid-flower timings. Fungicide applied 10 days pre-flower did not result in a yield difference from check. Thousand kernel weights were increased by fungicide application at all dates with the greatest increase in TKW at early and mid-flower timings. Bushel weights were not impacted by fungicide application at any timing.

Table 1. Effect of Headline fungicide application timing on mycosphaerella blight severity, ascochyta foot rot severity, yield, thousand kernel weight (TKW) and bushel weight of CDC Mozart field pea.

	Mycosphaerella blight (% leaf area affected)			Ascochyta foot rot	Yield	TKW	Bushel weight
	Upper	Mid	Lower	(0 - 9)	(kg/ha)	(grams)	(kg/hl)
Check	27 a	50 a	75 a	6.0 a	4621 c	218.7 c	84.0 a
6" vine	19 b	40 b	54 b	2.5 b	5112 ab	226.3 b	83.6 a
pre-flower	18 b	28 c	37 c	2.5 b	4891 bc	231.1 ab	83.6 a
early flower	13 c	16 d	22 d	2.2 b	5225 a	236.7 a	83.2 a
mid-flower	4 d	10 d	21 d	3.5 b	5000 ab	235.1 a	83.5 a
$Lsd_{(0.05)}$	4.6	6.7	13.1	1.4	271.0	6.0	1.0

CONCLUSIONS: Early fungicide application did not appear to reduce disease symptoms as much as application at early or mid-flowering. However, reduction in foot rot symptoms was equally effective at all application timings and yield of the early timing application (6" vine length) was similar to that of the first and mid-flower timings. Only the application at 10 days pre-flower did not result in a statistical difference in yield from the check. These results indicate that more research is required to determine best management practices for fungicide application timing to maximize yield of field pea in the Parkland environment.

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IMPROVING EFFECTIVENESS OF SEEDROW-PLACED UREA WITH AGROTAIN FOR CANOLA AND WHEAT USING KNIVES AND SHOVELS

ABSTRACT

Seedrow-placed urea minmizes soil disturbance in reduced tillage systems, but it generally decreases emergence at N rates adequate for optimum crop yield. The objective of this study was to determine the influence of different combinations of seed/fertilizer placement methods, opener types and coating urea fertilizer granules with a urease inhibitor (Agrotain™) on the emergence, seed yield, oil content in canola seed, and protein content and N uptake in seed of canola (*Brassica napus* L.) and wheat (*Triticum turgidum* L.). Field experiments were conducted in 2003 at the Melfort Research Farm, Saskatchewan. The treatments were combinations of N rates (40, 80 and 120 kg N ha^{-1}), urea coatings (non-coated urea (NCU), urea coated with Agrotain™ at 5.2 L t^{-1}) and three methods of placement (side-banded N with knivese with 1.9 cm wide band, seedrow-placed N with knives with 1.9 cm wide band and seedrow-placed N with shovels with 20 cm wide spreader band to cover almost 90% of the area). A zero-N control was also included for both knife and shovel treatments. Agrotain™ contained N-(n-butyl)-thiophosphoric triamide (NBPT) urease inhibitor at 25% by weight as active ingredient. In canola , side-band had no detrimental effect on emergence. With seedrow-placement, canola emergence was decreased substantially with application of N at 40 kg N ha^{-1} rate compared to the zero-N control, and was further declined with an increase in the N rate beyond 40 kg N ha^{-1}. The decline in canola emergence was much greater with NCU than with coated urea. In the NCU treatments, canola seed yield tended to decrease with increasing N rate in side-band treatments, but it was declined substantially when urea was seedrow-placed. In the Agrotain™-treated urea treatments, canola seed yield decreased with increasing N rate, but the decrease was much less than NCU. The wider spreader opener had emergence similar to side-band in most cases (except 120 kg N ha^{-1}), tended to give more seed yield than side-band, and resulted in greater emergence, seed yield and N uptake than knife opener. Coating of urea was less effective than widening of the seedrow-placement band. In wheat, side-band did not result in any significant decline in emergence. But, seedrow-placment with knives decreased emergence significantly with increase N rate from 40 to 120 kg N ha^{-1}. The decline in emergence tended to be greater for NCU than for coated urea treatments. The seed yield was less in NCU treatments than in Agrotain™-treated urea treatments. In summary, the emergence and seed yield were generally greater with coated urea than with NCU. The effectiveness of coating tended to increase with increasing N rate. Coating of urea was inferior to widening of the seedrow-placement band, and spreader was much more effective than knife opener.

BACKGROUND

Urea is cost effective compared to other N fertilizers. Seedrow-placement of urea is a popular option for producers as it allows seeding and fertilizer application in single operation, and also reduces labour, fuel, equipment, draft and time requirements, and soil disturbance. Band placement also reduces volatilization losses of N from urea and improves fertilizer use

efficiency. However, the proximity of urea to seed when applied in the same band has results in seedling damage at N rates adequate for optimum crop yield.

Canola and wheat are major cash crops in the Parkland region of Saskatchewan, and these are usually grown in a rotation with pulses and other cereal and oilseed crops. Most soils in the Parkland region contain insufficient amounts of plant-available N for optimum production. So, N fertilizer (along with other fertilizers) has to be applied. One pass seeding and fertilizer application (i.e., direct seeding) reduces time, cost and equipment needs for seeding, tillage intensity, and loss of soil and water, but it needs relatively larger, complex and expensive seeding equipment for placement of seed and fertilizer in separate bands. To avoid or inability to incur extra cost on seeding equipment, many producers tend to place the fertilizer in the seedrow band, which has the potential to reduce emergence and yield. Width of the seedrow band and type of seedrow opener can influence the rate of N that can be safely placed in the seedrow. Other factors which affect the amount of seedrow-placed N fertilizer are: soil texture, soil moisture and drying, crop type, row spacing, depth of seeding and urease inhibitor etc.

The objective of this study was to determine the influence of different combinations of seed/fertilizer placement methods, opener types and coating urea fertilizer granules with a urease inhibitor (Agrotain^{TM}) on the emergence, seed yield, oil content in canola seed, and protein content and N uptake in seed of canola (*Brassica napus* L.) and wheat (*Triticum turgidum* L.). Oil content in canola seed, protein content and N uptake in seed of canola and wheat were determined to assess any treatment effect on seed quality and N use efficiency.

MATERIALS AND METHODS

Field experiments were conducted in 2003 at Melfort Research Farm in Saskatchewan, Canada. Canola (*Brassica napus* L. cv. 225RR) and wheat (*Triticum turgidum* L. cv. Ac Barrie) were the test crops. Soil was a clay loam Black Chernozem (Udic Boroll). Mean annual precipitation of the area is 450 mm. Growing season extends from May to September. A randomized complete block design was used to lay out the treatments in four replications. There were three replications at Aneroid and Swift current, and four replications at Scott. The treatments were combinations of N rates (40, 80 and 120 kg N ha^{-1}), urea coatings (non-coated urea (NCU), urea coated with Agrotain^{TM} at full rate (5.2 L t^{-1}) and three methods of placement (side-banded N with knife with 1.9 cm wide band, seedrow-placed N with knife with 1.9 cm wide band and seedrow-placed N with shovel with a spreader band width of 20 cm). A zero-N control for both knife and shovel was also included in each block to assess if the crops were responsive to N application. All plots received blanket application (surface-broadcast) of 30 kg P ha^{-1} (as triple superphosphate), 20 kg K and 17 kg S ha^{-1} (as potassium sulphate) prior to sowing.

Agrotain^{TM} (containing N-(*n*-butyl)-thiophosphoric triamide (NBPT) urease inhibitor at 25% by weight as active ingredient) coating was used to slow urea hydrolysis. The rate of Agrotain^{TM} coating was 5.2 (0.13% NBPT by weight). Briefly, granular urea was sprayed with Agrotain^{TM} in a commercial fertilizer blender to coat the fertilizer granules.

Plots were seeded with a 4.5 m wide Flexicoil 5000 research drill using 22.5 cm row spacing. The drill was fitted with changeable 1.9 cm stealth openers (knife) and had Flexicoil 20 cm shovels (spreader band to cover about 90% area). Each plot was 15 m long and 4.5 m

wide. Seeding was done on May Seedling emergence was measured by counting the number of plants in six 1-m long rows about 3 weeks after seeding and seed yield was determined by combine harvesting a 15 m long and 1.2 m wide strip in each subplot. Seed samples of canola were analysed for oil content ( ). Canola and wheat seed samples were analysed for total N by near infrared reflectance (NIR) and protein content was calculated by multiplying the total N concentration by 5.70. The data were subjected to analyses of variance using GLM procedure in SAS (SAS Institute Inc. 1993) and $LSD_{0.05}$ was used for mean separation.

RESULTS

Canola

Emergence:

In the NCU treatments, there was no effect of N rate on seedling emergence of canola with side-banding (Table 1). However, there was a substantial decline in emergence in plots with seedrow-placed urea using knives. The emergence of canola declined from 203 plants/m^2 in the zero-N control to only 21 plants/m^2 at the 120 kg N/ha rate. In plots where urea was seedrow-placed with shovels (spreader opener using 90% area) , there was no reduction in emergence at 40 and 80 kg N/ha rates but in the 120 kg N/ha treatment the number of canola plants emerged was decreased to 126 plants/m^2.

In the Agrotain-treated urea plots, increasing N had no effect on emergence in the side-banding treatment. In the seedrow-placed plots where knives were used, emergence decreased significantly with increasing N rate but the decline in emergence from N application in Agrotain™-treated urea plots was much less than in the NCU urea plots. In the shovels treatment, there was no reduction in emergence at the 40 kg N/ha rate, but at the 80 and 120 kg N/ha rates there was some (but significant) decline in emergence. The decline in emergence due to N fertilizer in seedrow was much less with shovels than with knives.

The spreader opener resulted in more canola emerging than knife with all the N rates at both sites in the majority of cases. The differences in canola emergence between knife and spreader openers were not influenced by urea coating treatments.

In summary, emergence of canola was lower with seedrow-placed urea when knives were used than when urea was side-banded in most cases. The differences in emergence between seedrow-placed knives and side-banded urea increased with increasing N rate. In the seedrow-placed plots with knives, canola emergence improved by coating urea with Agrotain™, but emergence was much less than shovels, particularly less than side-banding which had the highest emergence. This indicated that the use of Agrotain™ coating reduced the detrimental effect of urea toxicity on emergence but did not eliminate it completely. In the Agrotain™-treated urea treatment, shovels had significantly higher canola emergence than knives, but for shovels Agrotain coating had no consistent effect in improving emergence compared to NCU.

Seed Yield:

In 2003 growing season, there was drought in mid July to most of August. Because of this, canola seed yields were low, and were much lower than in a normal year. There was little or no seed yield increase from applied N over the zero-N control (Table 2). In the NCU urea treatments, seed yield tended to decrease with side-band placement, especially at high N rates. In the seedrow-placed treatment with knives, seed yield was decreased significantly with

application of urea at 40 kg N/ha rate, and was further reduced considerably at the 80 and 120 kg N/ha rates. In plots where urea was seedrow-placed with shovels, seed yield tended to increase with N application at 40 or 80 kg N/ha rates over the zero-N control.

In plots receiving Agrotain™-treated urea, there was no increase in seed yield from side-banded N application compared to zero-N control. With knives, seed yield tended to decrease at 40 kg N/ha rate, and significantly decreased with further increase in N rate. But, the decrease in seed yield from seedrow-placed N using knives was much less with Agrotain™-treated urea compared to NCU urea. Shovels gave the highest seed yield, and in this treatment there was no difference in seed yields between NCU urea and Agrotain™-treated urea treatments.

The seed yield of canola was significantly lower with the knife opener than the spreader opener at all the N rates. But, coating of urea tended to reduce the yield differences between the knife and shovel openers.

In summary, there was little seed yield response of canola to applied N. Seed yield was lower with seedrow-placed urea using knives than side-banded urea in most cases. Like emergence, the differences in seed yield between seedrow-placed urea with knives and side-banded urea increased at higher N rates. In seedrow-placed plots with knives, seed yield was improved by using urea coated with Agrotain™, but yield was still less than side-banded N, and particularly less than shovels which had the greatest seed yield. In the shovels treatment, Agrotain™ coating had no effect on seed yield improvement compared to NCU.

Wheat

Emergence:

In the NCU treatments, there was no detrimental effect of N rate on seedling emergence of wheat with side-banding (Table 3). In plots with seedrow-placed urea using knives, there was some decline (though significant) in emergence from N application at 40 kg N ha^{-1} compared to zero-N control, and the emergence tended to decrease further with increasing N rate. In the shovels treatment, emergence tended to decrease with N rate. In the knives treatment, coating urea with Agrotain™ improved emergence at 40 kg N/ha rate, but the effect was not significant at 80 and 120 kg N/ha rates, because wheat emergence also declined significantly in Agrotain™-treated urea treatments at these high N rates. In plots with shovels, Agrotain™ had no effect on emergence. The emergence of wheat was lower with knife compared to spreader shovel or side-band at 40 to 120 kg N ha^{-1} rates and urea treatments, and the differences between knife and spreader tended to increase with N rate.

In summary, wheat showed a smaller decline in emergence than canola at 40 kg N ha^{-1} compared to the zero-N control, but a trend of consistent decline was observed with increase in N rate from 40 to 120 kg N ha^{-1}. The decline in emergence tended to be greater in NCU treatments compared to coated urea treatments.

Seed Yield:

In the growing season, there was drought in mid July to most of August, but wheat seed yields were much less affected by drought than canola. In the zero-N treatment, seed yield was significantly greater with shovels than with knives (Table 4), in spite of more number of plants with knives than with shovels (Table 3). In the side-banded treatment, there

was increase in seed yield from N application up to 80 kg N/ha rate. In the seed-placed treatment with knives, seed yield was decreased significantly compared to side-banded urea, and the yield gap widened with increasing N rate. In plots where urea was seedrow-placed with shovels, seed yields were similar to side-banded urea.

In plots receiving Agrotain^{TM}-treated urea, there was significant increase in seed yield from side-banded N application compared to zero-N control. In seedrow-placed treatment, seed yields tended to be less with knives than side-banded N, but seed yield with knives continued to increase with N rate (though still less than side-banded N). In the shovels treatment, seed yield response to applied N increased with increasing N rate, with a maximum yield at the 120 kg N/ha rate.

The seed yield of wheat was significantly lower with the knife than the spreader opener in most cases. The differences in seed yield between the knife and spreader increased with increasing N rate.

In summary, seed yield of wheat was lower with seedrow-placed urea using knives than side-banded urea in most cases. In seedrow-placed plots with knives, seed yield improved from the use of Agrotain-treated urea, with most yield improvement at the highest rate of 120 kg N/ha used in this study. The highest seed yield was obtained in plots receiving Agrotain^{TM}-treated urea using shovels.

SUMMARY

The emergence and seed yield data suggest that the wider scatter of seed and fertilizer achieved with the spreader opener reduced the toxicity of urea to seedlings compared to a more confined band achieved with knife and this effect became more pronounced with increase in N rate. Overall, opener type caused relatively larger change in emergence and seed yield compared to the impact of the urea coating treatments. Because the coating of urea was not able to fully overcome urea toxicity from seedrow-placement, particularly at the N rates likely to be adequate for optimum crop yield, it cannot be considered as a stand-alone solution to overcome the urea toxicity from seedrow-placed urea. In view of these findings, combination of urea coating with Agrotain^{TM} (0.13%) and wider seedrow-placement band may be an appropriate approach to apply adequate amount of N using urea for optimum yield, but long-term information is needed to draw valid conclusions.

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2003 Annual Report for the Melfort Swine Manure Response Experiment, With and Without Added Sulfur Fertilizer (January 16, 2004)

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Melfort Experiment 2003 Overview (Tables of Results Data are Appended to Report)

Canola yield in 2003 responded significantly to liquid swine manure injection, with a tripling of the yields over the unfertilized control. Sulfur deficiency continued to be a limitation on crop production in treatments that did not receive S fertilization, with urea without S yields the same as the unfertilized control. Urea + S had nearly 4 times the yield of the urea treatment without S. Overall, the 2003 canola yield was generally found to respond positively and significantly to residual soil sulfur from an application of 40kgS/ha made as elemental S or potassium sulfate at the start of the 2002 growing season. Although the swine manure evidently supplies some sulfur, it is not enough for maximum yield, as addition of sulfur generally resulted in a yield advantage of ~ 400 kg/ha over the no S manure treatments. The elemental S and sulfate sources both had similar residual benefits in terms of yield responses. Poor yields from S deficiency may be the reason for the observed low soil organic carbon levels in the urea only treatment and it may be concluded that proper nutrient balance is important for maximum C sequestration. Sulfur fertilization also enhanced protein content of the canola.

These results are pointing to the need to add supplemental fertilizer sulfur in swine manured S deficient soils to maximize crop yield and crop quality in both cereal and oilseed production. Furthermore, it appears that there can be significant residual benefit in year two from a single broadcast application of sulfur as either elemental S or potassium sulfate.

Melfort 2003 Specific Observations

Spring 0-15 cm depth Soil Characteristics After Manure Application the Previous Fall

- No significant influence of manure treatment on soil pH. The pH values among treatments are very similar. 4 years of application has not had an effect on pH, but rates are not really high. Also, E.C. is low with very slight impact of manure addition the previous fall on increasing E.C. i.e., control E.C. 0.14 mS/cm to 0.23mS/cm in 1X treatment. While increase is statistically significant, it is not biologically significant.
- The organic carbon in manure treatments is slightly elevated (0.1%), but noteworthy that urea treatment O.C. is lower. Remember that S deficiency greatly limited response

to added N in this treatment over the last 4 years. The N instead may have just stimulated microbial activity and decomposition of organic matter, resulting in reduced surface soil O.C., especially considering the low yields and residue inputs to begin with.

- Total N followed similar to O.C. as expected, since nearly all total N is organic N. Total N is lower in urea treatment than control, but not statistically significant. Not as big a decrease in N as O.C., since would expect some excess N to accumulate. Also the urea treatment N rate is only 80 kg N/ha.
- The soil Total P is enhanced by annual application at the 1X rate (3300 gpa), but not by 2X every second year, which is odd since it is the same total amount of manure. Still, the 1X enhancement is not statistically significant (large S.D.). Overall, not much impact on total P, also not much impact on Kelowna extractable P. In fact, no significant differences among any treatments in Kelowna P, all very similar and low. Urea has lowest Kelowna P. There is no evidence of P build-up, loading here either, same as what we observed for Dixon site.
- Kelowna extractable K is significantly increased by manure application, not affected by urea. This is what would be expected. As well, the 1X every year for four years versus 2X rate every second year (same total amount of manure over four years) produces very similar extractable K values as would be expected.
- As expected, spring nitrate-nitrogen is higher (5 times higher) in 1-1-1-1 than in control due to manure addition. The 2-0-2-0 is also significantly higher despite no manure addition the previous fall. This might be related to greater mineralization in the 2-0-2-0, even though it has only seen two years of manure application (12000 gpa total). Urea increased nitrate from 8.5 to 13.2 kg N/ha in top 15 cm, but not as much as 1X manure. Manure went on in fall, but Urea did not go on until spring at seeding. The ammonium N was slightly but significantly enhanced in manure and urea treatments.
- Sulfate in manure treatments was slightly but not statistically higher than the control. Urea treatment was lower than control. Note that compared to the other three long-term swine manure sites, the soil extractable sulfates at Melfort are about 10 times lower! No wonder S deficiency is a problem here and there is response to added S. At Melfort site 0-15 cm 2-6 kg S/ha versus 20-30 kg S / ha at the other sites.

Melfort Swine Manure 2003 Canola Harvest

Yield

- Compared to the control, the 1X annual rate 1-1-1-1 tripled canola grain yield from 600 kg/ha to 1780 kg/ha. Same trend evident for straw yield. The 2-0-2-0 still had double the grain yield over the control, so residual effects are evident, but yield still 400 kg/ha less than 1-1-1-1. The 3-0-0-3 with 9900 gpa for 2003 after nothing for the previous two years yielded the highest at 2200 kg/ha. The urea treatment yielded only 660 kg / ha due to severe S deficiency!
- The effect of adding S fertilizer at 40 kg S/ha in the spring of 2002 prior to growing oats has carried over into 2003! There is a significant residual beneficial effect.

- There was no significant effect of S fertilization on control yield, but for 1-1-1-1, the Tiger 90 elemental had the highest yield 2173 kg/ha versus 1783 kg/ha for no S. Sulfate was 1900 kg/ha.
  For 2-0-2-0, both Tiger 90 elemental and sulfate increased yield by about 400 kg/ha
  For 3-0-0-3, there was no significant effect of sulfur fertilization. The yields were all similar. For very high rates of manure in the year of application, the manure itself must supply enough S.
  For urea, the S fertilizer applications made two years previous resulted in more than tripling of yield.
- Fertilization with sulfur, either sulfate or elemental at 40 kg S/ha has produced significant residual benefit in year 2. The Tiger 90 elemental works well in this application. Need to use S fertilization with manure on these kinds of soils as huge yield benefit.

Grain and Straw N and S Concentrations

- Adding manure significantly increased grain and straw N concentration, with greater rates i.e., 1-1-1-1 vs 3-0-0-3 producing higher N concentration (3.6 to 4.3%N). Protein benefit. Note that urea without S had both lowest yield and seed N concentration (protein) therefore economically bad!
- Sulfur fertilization tended to increase grain N concentrations slightly in manured treatments and produced a huge increase in grain N concentration and a concomitant decrease in straw N concentration in the canola, presumably because the S allowed the normal physiology, movement to the seed and protein production to take place.
- Grain sulfur concentrations tended to significantly increase with manure addition compared to the control, while straw S concentrations tended to decline, suggesting that the added N plus S in manure is enhancing protein production and accumulation in the seed. The exception is the urea treatment which is highly S deficient and with very low grain and straw S concentrations.
- Sulfur fertilization of the manure treatments tended to produce slight increases in grain and straw S concentrations in line with the moderate yield increases they were associated with. With urea treatments, the S fertilization produced a near doubling of the grain S concentration, from 0.19%S unfertilized to 0.47%S fertilized.

Schoenau et al. Swine Manure Project Melfort, SK. Site 2003 (2003 Canola Crop Harvest)

Note 1: Crop harvest (grain and straw) means in kg ha^{-1}.
2: Carbon, nitrogen, and sulfur means in percent (%).
3: Means in the first column are followed by Standard deviations in the Second column.
4: N=Number of observations.

Table 1 Effects of hog manure rate on canola yield, and C, N and S concentrations at Melfort in 2003

	Manure rate					Yield (kg ha^{-1})		C concentration (%)		S concentrati	
Treatment	2000	2001	2002	2003	N	Grain	Straw	Grain	Straw	Grain	S
1	0	0	0	0	12	650	1351	61.4	44.1	0.34	C
2	1	1	1	1	12	1952	3857	60.1	43.3	0.44	C
3	2	0	2	0	12	1577	3070	60.5	43.7	0.42	C
4	3	0	0	3	12	2133	3831	59.2	43.0	0.52	C
5	U	U	U	U	12	1510	3485	49.1	44.2	0.35	C
LSD(0.10)						226	399	5.7	0.7	0.05	C

Table 2 Effects of sulfur application on canola yield, and C, N and S concentrations at Melfort in 2003

			Yield (kg ha^{-1})		C concentration (%)		S concentrati	
Treatment	Sulfur application	N	Grain	Straw	Grain	Straw	Grain	S
1	No Sulphur Added	20	1324	2977	53.8	44.2	0.38	C
2	Elemental S (Tiger 90)	20	1679	3321	60.2	43.8	0.41	C
3	Potassium Sulfate(K_2SO_4)	20	1690	3060	60.2	43.0	0.46	C
LSD(0.10)			175	309	4.5	0.5	0.04	C

Table 3 Effects of rate of manure X sulfur amendment on canola yield, and C, N and S concentrations at Melfort in 2003

	Manure rate					Yield (kg ha^{-1})				C concentration (%)				S concentra	
Treatment	2000	2001	2002	2003	N	Grain	Sd	Straw	Sd	Grain	Sd	Straw	Sd	Grain	Sd
1	0	0	0	0											
	No S				4	635	236	1315	402	61.4	0.2	45.2	1.0	0.34	0.0
	Tiger 90				4	570	246	1225	411	61.4	0.1	43.7	0.9	0.34	0.0
	SO_4-S				4	745	140	1512	365	61.3	0.4	43.5	1.3	0.35	0.0
2	1	1	1	1	12										
	No S				4	1783	343	3733	726	60.0	0.2	43.4	0.7	0.43	0.0

	Tiger 90				4	2173	355	4205	764	60.3	0.4	43.1	1.1	0.41	0.0
	SO_4-S				4	1900	479	3635	917	60.1	0.5	43.4	1.1	0.47	0.0
3	2	0	2	0	12										
	No S				4	1388	360	3025	762	60.2	0.6	44.0	1.0	0.42	0.0
	Tiger 90				4	1635	495	3193	746	60.8	0.4	44.1	0.4	0.41	0.0
	SO_4-S				4	1707	506	2993	981	60.6	0.2	43.0	1.0	0.43	0.0
4	3	0	0	3	12										
	No S				4	2155	191	4123	222	59.1	0.7	43.8	1.2	0.50	0.0
	Tiger 90				4	2175	160	3892	405	59.1	0.7	43.2	0.8	0.50	0.0
	SO_4-S				4	2068	285	3478	471	59.3	0.3	42.1	0.6	0.56	0.0
5	U	U	U	U	12										
	No S				4	660	1190	2688	2057	28.1	32.6	44.6	0.9	0.19	0.2
	Tiger 90				4	1840	259	4088	385	59.5	1.5	44.7	0.7	0.37	0.0
	SO_4-S				4	2030	108	3680	346	59.7	0.5	43.3	0.8	0.47	0.0
LSD(0.10)						470		831		10.0		1.1		0.08	

Note 1: Grain and straw yield means in kg ha^{-1}.
2: Means in the first column are followed by Standard deviations in the second column.
3: N=Number of observations.
4: Total N, Total P, Kelowna K, Kelowna P, Nitrate-N, Ammonium-N and Sulfate-S means are in kg ha^{-1}.
5: E.C. means in mS cm^{-1}.
6: Organic Carbon means in percent (%).

Table 4a Effects of manure rate on canola yield, and soil pH and nutrient contents (Melfort Hog Manure Site)

	Manure rate				N	Grain yield (kg ha^{-1})		Straw yield
Treatment	2000	2001		Sd			Sd	
1	0	0	0	0	4	635	236	1315
2	1	1	1	1	4	1783	343	3733
3	2	0	2	0	4	1388	360	3025
5	U2	U2	U2	U2	4	660	1190	2688
LSD(0.10)						560		946

Table 4b Effects of manure rate on canola yield, andsoil pH and nutrient contents (Melfort Hog Manure Site)

	Manure rate			N	pH	Elect.Cond. mS cm^{-1}		Org.Carbon (%)	
Treatment	2000	2001	Sd			Sd	Sd		Sd

1	0	0	0	0	4	6.8	0.1	0.14	0.01	3.8	0.3
2	1	1	1	1	4	6.7	0.3	0.23	0.03	3.9	0.5
3	2	0	2	0	4	6.8	0.2	0.17	0.01	3.9	0.4
5	U2	U2	U2	U2	4	6.9	0.2	0.15	0.01	3.5	0.5
LSD(0.10)						0.1		0.02		0.3	

Table 4c Effects of manure rate on canola yield, andsoil pH and nutrient contents (Melfort Hog Manure Site)

	Manure rate				N	Kelowna K (kg ha^{-1})		Kelowna P. (kg ha^{-1})		NO_3-N (kg ha^{-1})	
Treatment	2000	2001		Sd			Sd		Sd		Sd
1	0	0	0	0	4	641	172	3.3	1.3	8.5	3.6
2	1	1	1	1	4	853	136	3.5	0.8	42.5	12.
3	2	0	2	0	4	903	188	3.6	1.2	16.7	5.4
5	U2	U2	U2	U2	4	677	280	3.1	0.9	13.2	1.4
LSD(0.10)						157		0.8		8.5	

TITLE: EFFECT OF POTASSIUM CHLORIDE ON DISEASE SEVERITY AND PRODUCTIVITY OF WHEAT, 2003

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OBJECTIVE: to determine the impact of potassium chloride (KCl) fertilization on diseases of wheat in northeast Saskatchewan in 2003.

MATERIALS & METHODS: Plots were located at NW 7-49-16 West of 2nd with the co-operation of landowner Brent Freedman. The site was a sandy loam and in 2002 had been cropped to canola and field pea. Experimental design was a 6 replicate split plot with KCl treatments (0, 100 and 200 kg/ha of 0-0-60 applied in 2002) as main plots and crop stubbles of canola or field pea as sub-plots (4 X 10 M). AC Barrie wheat was direct seeded with a John Deere hoe drill with 7" row spacing on May 23 after heavy harrowing of the site. Seeding rate was 1.7 bushels/acre (100 lbs/ac) with 40 lb/ac (product) of 12-51-0 seed placed. Puma Super (2.6 L/ac) and Buctril M (0.4 L/ac) were applied for weed control on June 4th.

Twenty five plants were assessed for the % foliage diseased on the flag (F), flag-1 (F1) and on the whole plant (0-11) on August 5th. The subcrown internode of each plant was also assessed for % of the internode with symptoms of common root rot. Plots were harvested on August 26th with a Wintersteiger plot combine. Yield samples were assessed for quality data (thousand kernel weight, % plump seed and bushel weight).

RESULTS: The experiment was established with adequate spring soil moisture. See Table 1.

CONCLUSIONS: KCl fertility did not appear to impact the wheat diseases observed in 2003 nor yield or quality factors under the experimental conditions. Wheat seeded on field pea stubble appeared to have slightly less of the flag and flag-1 leaves affected by leaf spots and much greater yield was observed for treatments on pea stubble than canola stubble. Seed quality was not affected by stubble type.

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Table 1. Effect of KCl rates on wheat diseases (leaf spots and common root rot) - % of foliage with symptoms on the flag leaf, flag-1 leaf and whole plant, common root rot (CRR), yield (bu/ac), thousand kernel weight in grams (TKW), % plump seed (>6/64") and bulk density (kg/hl) at Gronlid, 2003. Data are the means of 6 replicates.

Treatment	Flag leaf	Flag-1 leaf	Whole plant	CRR	Yield	TKW	% Plump seed	Bulk Density
Rate of KCL (kg/ha)								
0	73 a	94 a	10.0 a	4.6 a	39.9 a	33.6 a	90.7 a	80.4 a
100	77 a	95 a	10.1 a	4.6 a	39.3 a	33.9 a	91.8 a	80.9 a
200	71 a	93 a	9.9 a	3.9 a	39.1 a	33.8 a	91.4 a	80.8 a
$Lsd_{(0.05)}$	10	3	0.3	1.8	3.4	0.9	1.4	0.7
Crop stubble								
Field pea	70 a	94 a	10.0 a	4.2 a	44.1 a	34.1 a	91.8 a	80.7 a
Canola	76 b	95 b	10.1 a	4.5 a	34.8 b	33.4 a	90.8 a	80.6 a
$Lsd_{(0.05)}$	4	1.0	0.1	1.2	2.5	0.8	1.4	0.6

2003 Project – Improvements to Forage Fertility

Cooperators: Northeast Agricultural Research Foundation (Gord Pearse, Garry Mayerle)
Gates Fertilizers (Andre Laforge)
Saskatchewan Soil Conservation Association
Alvin Ginter, producer

Objective: Sustainable forage production and fertility are two separate issues that have been identified as key issues pertaining to sequestration of greenhouse gasses, and best management practices as described by the Saskatchewan Soil Conservation Association. This project will demonstrate different types of nitrogen soil fertilizer products, as well as addressing other macronutrients, by determining yield differences in forage production.

Methods:

1) Site Selection

Alvin Ginter's cattle operation is situated four miles south of Carrot River, on the NW8-49-11-w2, in the Gray soil zone. The site selected is a three year old brome / alfalfa hay blend that had not been fertilized since establishment, which is typical management, especially considering the dry years of late. A soil sample was taken on April 24, and results obtained from Enviro-Test Laboratories indicated deficient levels of nitrogen, phosphorus, and potassium, and marginal levels of sulphur. Soil test nutrient levels of nitrate-nitrogen indicated 9 lbs/ac in the top 6 inches, and 11 lbs/ac from 6 to 24 inches. Phosphate and potassium levels were 12 and 136 lbs/ac respectively, in the top 6 inches. Sulphate-sulphur levels were determined to be 11 lbs/ac in the top 6 inches, and 40 lbs/ac from 6 to 24 inches.

ETL's nutrient recommendation rates for a goal of 2.5 ton/ac (5.60 T/ha), under a probability of 4.5 inches of precipitation were 100-110 lbs N/ac, 70-80 lbs P_2O_5/ac, 80-90 lbs K_2O/ac, and 0-10 lbs S/ac. A quick calculation would indicate a cost per acre approaching $100 if we followed that recommendation, so it was agreed that we would aim for the maximum application rates per acre of 65 lbs N, 0 lbs P_2O_5, 90 lbs K_2O, and whatever rate of S that would be additional to the N source. Mr. Laforge has considerable experience of the region's soils, and he, and other specialists indicated that broadcast phosphate does not provide immediate returns. ETL's recommendations were likely quite indicative of the severe deficiencies that can develop on older forage stands, but even our application rates were higher than most producers would consider affordable.

2) Treatment / Application Plan

The fertilizer treatments were applied north – south on visibly the most consistent soil of the 55 acre field. It was applied on May 17, with an airflow applicator with a 60 foot

boom width, creating a treatment plot size of 60 by 2400 foot area (3.31 acres). This trial is non-replicated, with the following treatments:

i. Check (no fertilizer application)
ii. 65 lbs N/ac, applied as urea (46-0-0)
iii. 65 lbs N/ac, applied as 46-0-0 with Agrotain ™ at 4.1 L / T
iv. 65 lbs N/ac, applied as 46-0-0, and 90 lbs K_2O, applied as potash (0-0-60)
v. 65 lbs N/ac and 74 lbs S/ac, applied as 21-0-0(24) fines
vi. 65 lbs N/ac, 74 lbs S/ac and 90 lbs K_2O, applied as 21-0-0(24) and 0-0-60

Agrotain is a urease inhibitor available to producers, which helps to reduce volatilization of urea, particularly under dry, low humidity, or windy spring conditions.

3) Data Collected

Soil moisture conditions in May, following a good spring runoff, were better than they had been for the previous two years, however below average May, June, and July moisture, and tremendous heat in June, July, and August severely depleted all soil moisture reserves. Therefore, moisture was the limiting growth and forage yield factor for 2003. The treatments were cut in early July on the same day, and harvested July 10 again on the same day. Harvest stage was at least 30 % bloom for the alfalfa, with the brome in flower. The entire plot was baled and then weighed for treatment yield. Below is the yield and return summary.

Treatment	Fertilizer Cost $/ac (inc. appl.)	Dry Forage Yield (lbs/ac)	% of Check	Gross Return Yield ($/ac)	2003 Application Contribution*	0-0-60 Contribution*
65 lbs N using 46-0-0, with Agrotain @ 4.1 L / T	$ 35.66	1914	123	$ 66.99	$ 0.35	
65 lbs N using 21-0-0(24) fines	$ 34.13	1857	119	$ 65.00	$ 0.31	
65 lbs N using 46-0-0	$ 31.36	1876	121	$ 65.66	$ 0.36	
Check	$ -	1554	100	$ 54.39	$ -	
65 lbs N, 90 lbs K2O, using 21-0-0(24), 0-0-60	$ 47.40	1932	124	$ 67.62	$ 0.28	$ 0.20
65 lbs N, 90 lbs K2O, using 46-0-0, 0-0-60	$ 44.63	1971	127	$ 68.99	$ 0.33	$ 0.25

* For every dollar spent on the treatment, the contribution is what is received. A number below one is a loss.

Assumption of costs:

46-0-0	$426.82 / T
21-0-0(24)	$215.00 / T
0-0-60	$195.00 / T
Agrotain	$312.00 per 9.46 L jugs
Granular application	$4.00 / ac

Brome/alfalfa round bale (1600-1700 lb basis) - $0.035/lb*

* Saskatchewan Hay Report, Saskatchewan Forage Council, October 2003

In late August and September, there were a few showers that caused marginal regrowth of the grass and alfalfa, from a very dry hay stand. In October, it was grazed by Mr. Ginter's cattle for twelve days, and there did not appear to be any visible differences in any of the six treatments, including the unfertilized check. However no second cut yield or clip data was taken.

Discussion: The yield versus moisture scenario developed by ETL suggested that in this part of the province there is a 75 % chance of receiving 4.5 inches of precipitation in the growing season. However, this level of moisture was not accumulated until September, and soil moisture conditions were entirely inadequate for an older forage crop such as this, especially considering the warmer than average growing season.

It should therefore be little surprise that there were uneconomical yield increases due to fertilizer application. All fertilizer treatments improved forage yield from 19 to 27 % above the unfertilized check, with the application of both potash and nitrogen producing the highest yields. However, considering the very poor yields of all treatments, all applications were uneconomical. Roughly one third of the cost of the treatment was returned to the producer, indicating a dead loss for these rates of fertilizer application, at least for this year. There was no significant treatment that had clearly the highest forage yield, nor the highest contribution margin. The smallest economic losses occurred with urea and urea with Agrotain.

There was also no contributing gain from the addition of potash to the nitrogen fertilizer, as the cost of $13.27 / acre resulted in less than $4.00 / acre in additional forage production.

Growing season moisture, and the predictability of receiving it, will always be the most difficult question in optimizing the use of your fertilizer. The application of all sources of nitrogen fertilizer was clearly uneconomical for improving forage yield for 2003. The producer hopes that he will realize a benefit of the fertilizer application next year. If visible differences between the unfertilized check and the treatments develop in the late spring of 2004, he will be interested in taking another years' data.

Project 2003Gates1: Effect of foliar fungicide on wheat yield
Cooperator, Location: Terry Gates, Nipawin

Objective:
The use of foliar fungicides on wheat or barley in northern Saskatchewan has generally been limited to high end producers who are quite mindful of inputs and their response to maximize net returns. There was very little foliar fungicide application on cereals in northeastern Saskatchewan in 2003, due to dry summer conditions, and little disease potential following the drought of 2002. This trial was established to determine if a yield response could be obtained from the product Tilt (active – propiconazole) in a good crop of hard red spring wheat, in a year with marginal conditions for leaf disease development.

Methods:
The trial was located on the NW 32 – 49 – 13 – w2 southeast of Nipawin. This trial was not replicated, although yield data was taken from the entire field, including all of the treated and untreated areas. Yield data was taken through the GreenStar John Deere yield recording system. The treatment was full rate Tilt 250E at 0.2 L/ac, applied as the wheat entered the flag leaf stage.

Results:
Data collection:
Little data was taken except for yield. Soil moisture conditions for the entire region were generally considered a capacity on May 1, with about 4 inches of rain in May and June. Virtually no rain fell in July or August.

Yield and economic evaluation:
This analysis includes only the cost of the foliar fungicide in relation to crop yield.

Treatment	Appl. Cost ($/ac) *	Yield (bu/ac)	% of Untreated	Gross Return ($/ac) **	Application Contribution ***
No Tilt	0.00	45.6	100	191.52	
Tilt	17.37	49.9	109	209.58	1.04

* Fungicide application cost per acre includes $13.95 for product, $3.50 for application, and cash opportunity cost of $0.42.
** Assuming $4.20/bu HRS wheat
*** For every dollar spent on the application, the contribution is the dollar amount that is received. A number below 1 is a loss.
Note: Syngenta, the marketers of Tilt, has a rebate program which may allow producers to receive a cheaper fungicide cost. These numbers are based on full retail value, and a cost savings would have made the contribution higher.

Conclusions:
There was a very slight economic advantage to applying the fungicide to this crop in 2003, although it improved the yield by 9 %. Another factor in this that was not tested was would be grain quality, which may alter the economic equation significantly if there was a difference in how the crop graded.

Note:

There were another two projects that were georeferenced and yield mapped, but due to our computer program failure, and the cost to replace the software, the results were never evaluated.